

For high throughput, high accuracy applications

Refractometer Selection Guide



Meeting the needs of your industry and application

- Food and Beverage
- Sugar Milling, Refining, Processing
- Chemical
- Pharmaceutical and Toxicology Testing
- Petroleum
- Flavor, Fragrance, Cosmetics

 **RUDOLPH
RESEARCH
ANALYTICAL**

Rudolph Research Analytical, serving its customers
with Integrity, Quality, and Innovation for over fifty years.

TECHNICAL BULLETIN 929

A Refractometer that's right for your industry and application

Every industry has its unique application requirements, environmental constraints and operator handling issues with which to contend. It is for this reason, that **Rudolph has more than 10 different model variations** to ensure that we have the right solution for your situation.

Maybe you are a pharmaceutical company looking for an instrument which can **measure below the standard food refractometer range** of 1.33 - 1.53 to comply with the USP monograph for Sevoflurane (refractive index range of 1.2745 - 1.2760) or other halogenated ethers and pharmaceuticals **measuring below 1.3 RI**. Maybe you're a flavor, fragrance or essential oil manufacturer or blender dealing with Cinnamic Aldehyde or the many products in this industry having **Refractive Indices greater than 1.60 RI**.

Possibly your main concern is not the range of the refractometer but the **reproducibility of results** – just listen to what one of our customers has to say after switching to Rudolph after years with another brand:



J357-MMC-CP

"Just wanted to let you know how pleased our company is with the J57HA Automatic Refractometers. We currently have two of the instruments in service in our sugar testing laboratories and are in the process of ordering three additional refractometers.

Before the decision was made to switch our laboratories to the J57HA Refractometers, rigorous testing was done on the instrument over the past year in our Quality/Research Laboratory.

It has been our policy when doing research type work, using our old refractometers, that we place a sample on the prism, set a timer for two minutes, then press the "Read" button until we get three readings in a row that are identical (this could take up to 12 readings). With the J57HA instrument, we place the sample on the prism, press the "Measure" button and in about 15 seconds we have a stable number. The instrument is so stable in fact, that I can honestly say after using the instrument for over a year, we have never had a different reading from the original measurement, no matter how many times we repeatedly press the "Measure" button."

– R.R., Senior Process Chemist, Western Sugar Cooperative



J57HA

How to use this guide

Although there are many common problems that are similar across all industries: like sample cleaning, sample cross contamination, dirty prism, improper water zero, **some problems are unique or have a different level of importance** to a particular industry. This model selection guide allows you to see which models are the most popular in your industry and why. Just select the category that best reflects your

industry and then call us to help solidify your model selection. Our technical sales representatives understand that the **initial price is an important part of the purchasing decision** but only part of that decision; equally, if not more important is **purchasing an instrument that works as intended for the application and meets all relevant standards, regulations and requirements** in the area in which you work.



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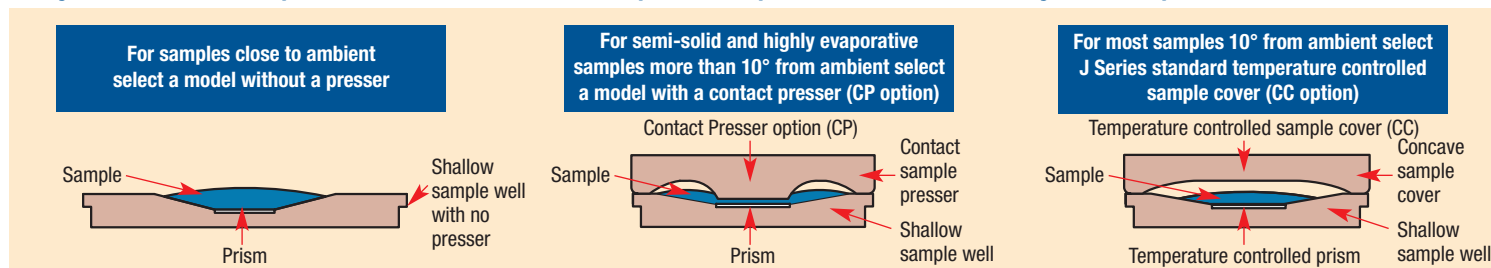


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Below are a few of the reasons customers replaced their old refractometer with a J-Series from Rudolph

Problem	Solution
 <p>You are tired of arguments over shadowline interpretation on your Abbe Refractometer. One person says the material is on specification, one person says it's not. In addition, scratches on the glass prism make visual interpretation even more difficult.</p>	<p>J-Series Internal Reflection Refractometers use scratch proof artificial sapphire prisms that measure the reflected light not the transmitted light, like the Abbe, so dark samples measure as easily as clear samples. Just put a drop of sample on the prism, press measure and walk away. No shadow line, no manual balancing or interpretation.</p>
 <p>Waterbath maintenance is costly and time consuming. Theoretically it should be easy – just top it off with water every week, clean it out and add new algacide once a month. So why does the bath always seem to be low on water and covered with green slime?</p>	<p>The J-Series has an electronic peltier temperature control solution that is right for you. Select your temperature through the touch screen and watch the instrument quickly come to temperature and make a measurement all in one easy step.</p>
 <p>Your old refractometer was great when you bought it but now it is being repaired more and more often while measurement instability wastes time and money.</p>	<p>Our customers say it best:</p> <p><i>"This instrument has greatly reduced our sample time and improved our accuracy. Calibration of the instrument is easy and rarely required. We have had no problems or issues with the two instruments that we currently have in service..."</i></p> <p><i>I would highly recommend the Rudolph J57HA Refractometer over any other brand of refractometer that I have used or tested throughout my many years working in the sugar industry."</i></p>

Why switch to a Rudolph Research Refractometer? Superior temperature control and easy to clean prism



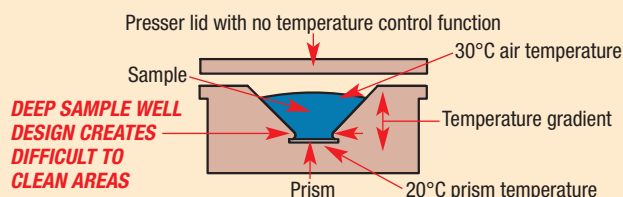
Rudolph's dual temperature control system

Rudolph Research Analytical is the only refractometer manufacturer to offer **electronic temperature control from both prism and presser surfaces**. The requirements of an electronically temperature controlled refractometer operating close to ambient air temperature are very different from the temperature control requirements of a refractometer operating more than 10°C from ambient air temperature. Only the Rudolph J Series is designed to be the perfect refractometer for both applications.

Measuring RI or Brix close to ambient air temperature

The J57's shallow sample well and presserless design makes **cleaning easier than deep well prism designs while still maintaining accuracy**. The deep sample well of competing refractometers is not needed when there is less than a 10°C difference between the prism temperature and air temperature because the temperature gradient across the sample is small.

Other manufacturers at all temperatures



Measuring RI or Brix far from ambient air temperature

The J157/257/357 shallow well with temperature control from the sample presser and prism surface offers **superior temperature control while still maintaining ease of cleaning**. Rudolph's temperature controlled presser creates a mini temperature controlled environment where the entire sample is held at the measurement temperature. This design **minimizes the inaccuracies** created by temperature gradients across the sample as deep well prisms fight to control temperature from the prism surface while the air and upper part of the sample have widely divergent temperatures. (See Figure lower left)

Other manufacturer's compromise

From the pictures below one can see that **other manufacturers have to make a compromise with the depth and angle of sample well**. Since these manufacturers use one sample well and cover design for both temperature applications, they end up with a **sample well that is too narrow and deep. The deep sample well makes cleaning needlessly hard** at ambient temperature while failing to provide ideal temperature control when the sample and air temperature are more than 10°C from the desired measurement temperature.

Rudolph



Manufacturer 1



Manufacturer 2



- Total Parenteral Nutrition (TPN)
- Toxicology testing (Urine SG)
- Pharmacy compounding and drug diversion
- USP <831>
- EP 2.2.6
- Enflurane
- Sevoflurane



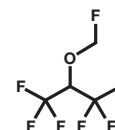
Feature Highlight

Enflurane, Sevoflurane and similar halogenated ethers are used extensively for the induction and maintenance of general anesthesia. Their manufacture must comply with specifications from the USP/EP or relevant pharmacopeias. Many of these pharmacopeias require the measurement of refractive index. For example, the US Pharmacopeia requires that sevoflurane has a refractive index of 1.2745 - 1.2760 at 20°C. **For 21CFR Part 11 compliance choose MMC option.**

Official Monographs, USP 31 / Sevoflurane

■ Sevoflurane

C₄H₈F₇O 200.05
Propane, 1,1,1,3,3,3-hexafluoro-2-(fluoromethoxy)-
Fluoromethyl 2,2,2-trifluoro-1-(trifluoromethyl)ethyl ether
[28523-86-6].



3867

Refractive index (831): between 1.2745 and 1.2760, at 20°C

Pharmaceutical Models	Specifications	Features and Benefits
J257-CC 	<ul style="list-style-type: none"> ■ Measurement Range: 1.26 - 1.70 RI; 0 - 95% Brix ■ Accuracy: 0.0001 RI; 0.1 Brix ■ Electronic Temperature Control: Flexible temperature selection between 15°C - 70°C 	<p>USP General Subchapter <831> Refractive Index States: ...Although the standard temperature for Pharmacopeial measurements is 25°C, many of the refractive index specifications in the individual monographs call for determining this value at 20°C. The temperature should be carefully adjusted and maintained, since the refractive index varies with the temperature...</p> <p>...To achieve the theoretical accuracy of ±0.0001, it is necessary to calibrate the instrument against a standard provided by the manufacturer and to check frequently the temperature control and cleanliness of the instrument by determining the refractive index of distilled water, which is 1.3330 at 20°C and 1.3325 at 25°C...</p> <p>The J357-MMC-CC provides the refractive index range, accuracy, performance and 21CFR Part 11 compliance demanded by big pharma making this our most popular pharmaceutical model.</p>
J357-MMC-CC 	<ul style="list-style-type: none"> ■ Measurement Range: 1.26 - 1.70 RI; 0 - 95% Brix ■ Accuracy: 0.00004 RI; 0.03 Brix ■ Electronic Temperature Control: Flexible temperature selection between 15°C - 100°C 	
Medical Testing and Toxicology Models	Specifications	Features and Benefits
J57HA 	<ul style="list-style-type: none"> ■ Measurement Range: 1.33 - 1.53 RI; 0 - 95% Brix, 1.000 - 1.0500 Urine SG ■ Accuracy: 0.0002 Urine SG; 0.00004 RI; 0.03 Brix ■ Electronic Temperature Control: Fixed temperature selection: 20°C and 25°C 	<p>The J-Series Refractometer is chosen by more toxicology labs than any other brand. These customers know that 0.0002 Urine SG accuracy must be validated regularly and Rudolph's J57 ensures that the refractive index performance and calibration requirements meet government regulations. The J57HA's standard sample volume is 500 micro liters but this can be reduced to 100 micro liters by selecting the J57HA-SV.</p>
J57HA-UF-SP 	<ul style="list-style-type: none"> ■ Measurement Range: 1.33 - 1.53 RI; 0 - 95% Brix, 1.000 - 1.0500 Urine SG ■ Accuracy: 0.0002 Urine SG; 0.00004 RI; 0.03 Brix ■ Electronic Temperature Control: Fixed temperature selection: 20°C and 25°C 	<p>SAMSHA labs doing hundreds of toxicology samples per day prefer to eliminate the human factor and choose large scale automation. The J57HA-UF-SP is combined with a custom automation solution that minimizes sample use and replaces the tested sample to the testing vial.</p>
J57TPN 	<ul style="list-style-type: none"> ■ Measurement Range: 1.33 - 1.53 RI; 0 - 95% Brix, 1.000 - 1.0500 Urine SG ■ Accuracy: 0.0002 Urine SG; 0.00004 RI; 0.03 Brix ■ Electronic Temperature Control: Fixed temperature selection: 20°C and 25°C 	<p>For large hospitals doing their own pharmaceutical compounding, ensuring that their Total Parenteral Nutrition formulas are accurate is life critical. The J57TPN was specifically customized to meet USP<797>. Please contact the factory for the white paper on this application.</p>



Calibration Kits

Rudolph Research Analytical offers three different calibration fluid kits. Each fluid kit comes complete with NIST Traceable Certificates for each fluid.

All Purpose

A23180 General Use NIST Traceable Calibration Fluids Kit

Kit consists of the following (5) NIST traceable calibration fluids (1 oz. each):

- A21752-1.3330-W RI Certified Water 20°C with table for 10-70°C
- A21752-1.350-20/Brix 10
- A21752-1.460-20/Brix 70
- A21752-1.516-Multi Temperature Fluid (20°, 30°, 40°)
- A21752-1.650-20 nominal RI

Pharmaceutical

A23180-VLR NIST Traceable Calibration Fluids Kit

(Special version for measuring halogenated ethers and general pharmaceuticals)

Kit consists of the following (5) NIST traceable calibration fluids (1 oz each):

- A21752-1.29-20
- A21752-1.3330-W RI Certified Water 20°C with table for 10 - 70°C
- A21752-1.460-20/Brix 70
- A21752-1516-Multi Temperature Fluid (20°C, 30°C, 40°C)
- A21752-1.650-20 nominal RI

Toxicology Testing

A23180-USG NIST Traceable Calibration Fluids Kit

(Special version for validating 4th decimal place Urine specific gravity refractometers)

Kit consists of the following (5) NIST traceable calibration fluids (1 oz each) at the major decisions points:

- A21752-1.3330-W 1.0000 - Urine SG
- A21752-1.0010 Urine SG
- A21752-1.0030 Urine SG
- A21752-1.0200 Urine SG
- Calibration fluid above 1.0300 (nominal for calibration)

All Calibration Fluid RI values are subject to change based on availability.

Many individual Refractive Index Calibration Fluids are available at various indices and temperatures. Contact a Customer Service Representative for assistance in choosing a fluid that is right for your application.

Office Style (parallel) Printer

These come in two main styles:

1. Inkjet Printer
2. Laser Printer

These office style printers have the following advantages:

- Large paper size (American standard 8 1/2 x 11 inches or A4) required by cGLP/cGMP and often preferred by regulating bodies such as FDA
- Multiple readings per page
- Inexpensive replacement cost
- Easy access to consumables

Rudolph Research Analytical

This sample was measured on a J357 refractometer, serial number 12129, manufactured by Rudolph Research Analytical, Hackettstown, NJ.

Last Calibration : Aug 20, 2006 12:23:42

Lot Identifier : Test print

Operator Name : _____

Operator Signature : _____

No	Sample ID	Measurement	Temp.	Time	Date
1	2712	1.57023 Refractive Index	20.0C	12:51:44	Aug 22, 2006
2	2712	1.57023 Refractive Index	20.0C	12:51:59	Aug 22, 2006
3	2712	1.57023 Refractive Index	20.0C	12:52:06	Aug 22, 2006

n = 3		Average = 1.57023	Standard Deviation = 0.000000		

Rudolph Research Analytical

Measurement
1.60006 Refractive Index

Temperature
28.0C

Temperature Correction
off

Time
12:25:28

Date
Aug 22, 2006

Last Calibration
Aug 28, 2006 12:23:42

Operator Name

Operator Signature

This sample was measured on a J357 refractometer, serial number 12129, manufactured by Rudolph Research Analytical, Hackettstown, NJ.

Strip Impact Printer

Receipt printers have the following advantages:

- Small footprint
- Designed for rough industrial environments
- Does not use thermal paper
- Industrial product with long model life, so that the printer is often available for many years



Barcode Reader

All Rudolph refractometers can be equipped with a barcode reader. The barcode reader has flexible programming enabling it to work with various barcode standards: Code 39, Codabar, Interleaved 2 of 5, UPC-A and others.

